USER MANUAL

DIGITAL I/O MODULE
(MODEL No. 40-410)

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pickering

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For Technical Support please contact Pickering Interfaces either by phone, fax, the website or via e-mail.

WARRANTY

All products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of two years from the date of delivery to the original purchaser. Any product found to be defective within this period will, at the discretion of Pickering Interfaces be repaired or replaced.

Warranty is on a return to factory basis, however, for most systems, the module may be replaced on a module exchange basis. A module will be delivered to the user and the faulty part returned to Pickering Interfaces on receipt.

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Observe the Electrostatic Sensitive Device Caution detailed in Section 8.

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CONTENTS

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SECTION 1 - INTRODUCTION

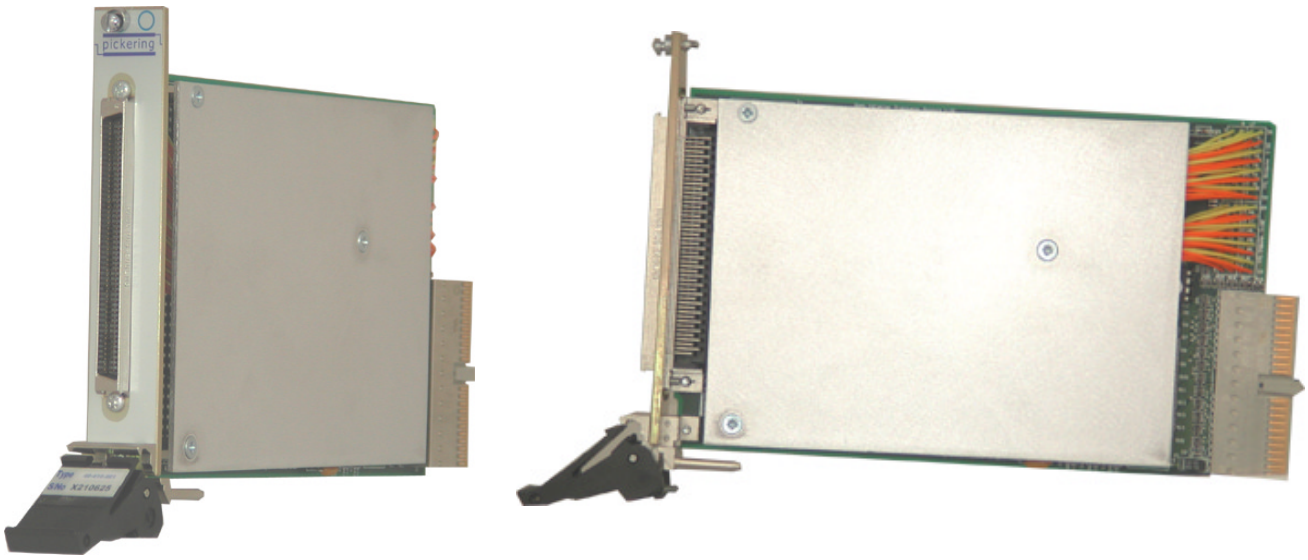
GENERAL

The 40-410 Digital I/O Module, which forms part of the System 40 Programmable Relay Switching System, provides 32 bit digital I/O and is used to operate external devices, such as heavy duty relays (power, RF and high voltage types), solenoids, lamps etc., or for interfacing with external logic, e.g. a programmable instrument with a BCD interface. The module is provided in the following configurations:

- 32In/32 Out (TTL O/P) 40-410-001
- 32In/32 Out (Open Collector O/P) 40-410-002

APPLICATIONS

The TTL output version of the module allows interaction with external logic and the Open Collector Transistor version allows operation of external devices with voltages to 50V d.c. and currents to 500mA. Applications include generating control signals, stimulus and sensing status from digital devices.



MECHANICAL DESCRIPTION

The Digital I/O Module conforms to the 3U height (128mm) Eurocard standard and comprises the following:

- CPCI Ejector Handle
- Front Panel mounted 96-way SCSI 2 Type connector
- Four 32 bit TTL I/O Drivers
- Four 32 bit Open Collector I/O Drivers
- Compact PCI backplane connector
- PCI Bridge (U1)
- Control Logic

The front panel is secured to the PCB by two M2.5 x 6mm pan-head posi-drive screws.

FUNCTIONAL DESCRIPTION

A functional block diagram is provided in Figure 1.1. The Module is powered by the +5V supply from the PXI backplane via Compact PCI connector J1. The interface to the user test equipment is via the front panel mounted 96-way SCSI type connector, J2. The module comprises Open Collector output drivers U16 to U19, TTL input/output drivers U8 to U15, control logic U3 to U4, configuration EEPROMS U2 and U7 and PCI Bridge U1. The module configuration, i.e. Open collector output or TTL output, is determined by data stored in EEPROM U7. U16 to U19 and U8 to U15 are addressed by PCI bridge U1 to output the required signal. PCI Bridge U1 is configured by EEPROM U2.

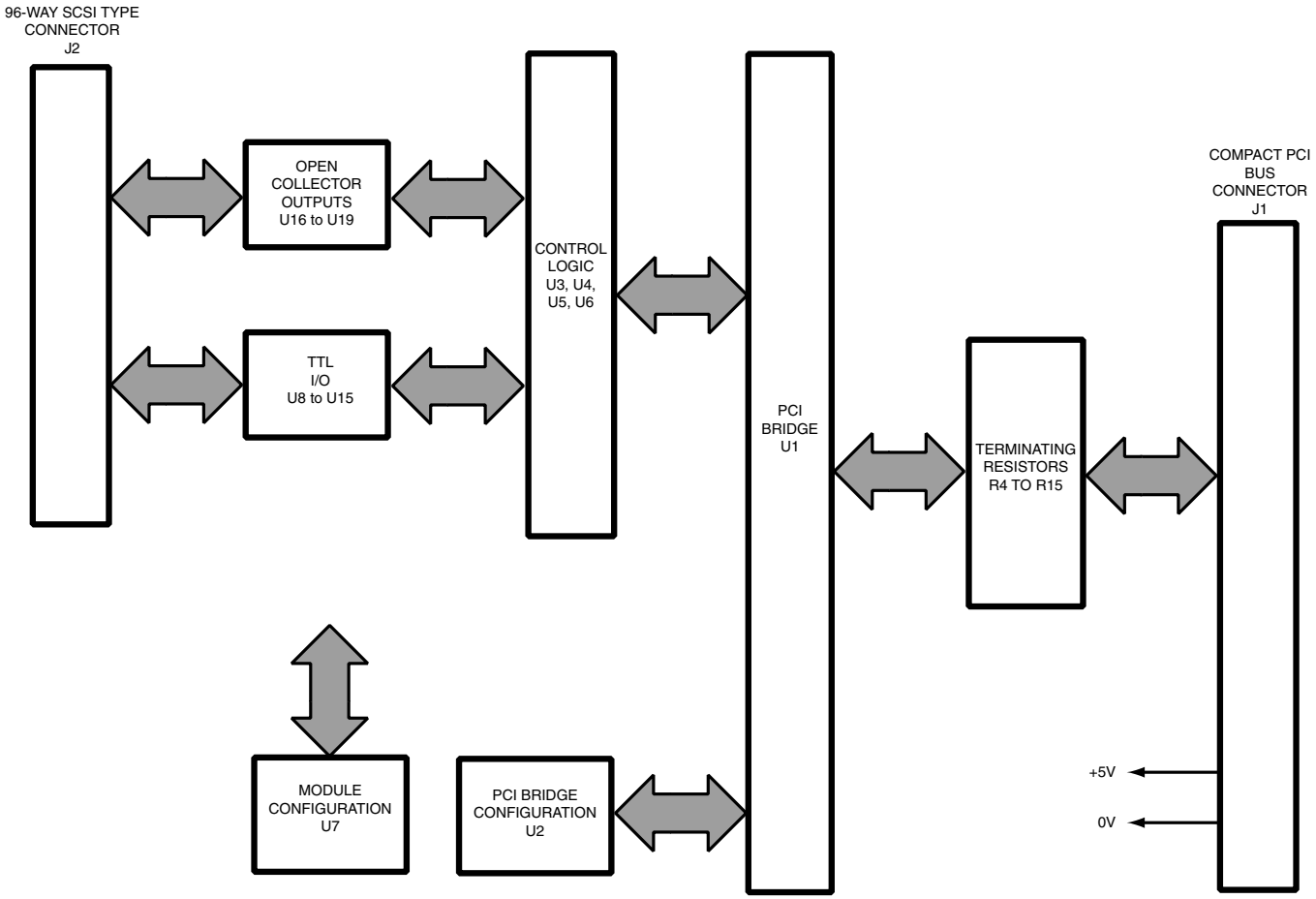


Figure 1.1 - Digital I/O Module 40-410: Functional Block Diagram

SECTION 2 - INSTALLATION

CAUTION

Electrostatic discharge can damage the components on the module. To avoid such damage in handling the board, touch the anti-static bag to a metal part of the chassis before removing the board from the bag.

The module should be installed in accordance with the following procedure:

1. Ensure that the system is turned OFF but still connected to mains so that it remains grounded.
2. Choose an appropriate slot in the rack (refer to the slot address information in Section 4).
3. Remove the slot cover for the chosen slot.
4. Ensure that the injector/ejector handle is in its downward position. Align the module with the card guides on the top and bottom of the slot.

CAUTION

Do not raise the injector/ejector handle whilst inserting the module. The module will not insert properly unless the handle is in its downward position.

5. Hold the handle whilst slowly sliding the module into the card guides until the handle catches on the injector/ejector rail (refer to Figure 2.1).

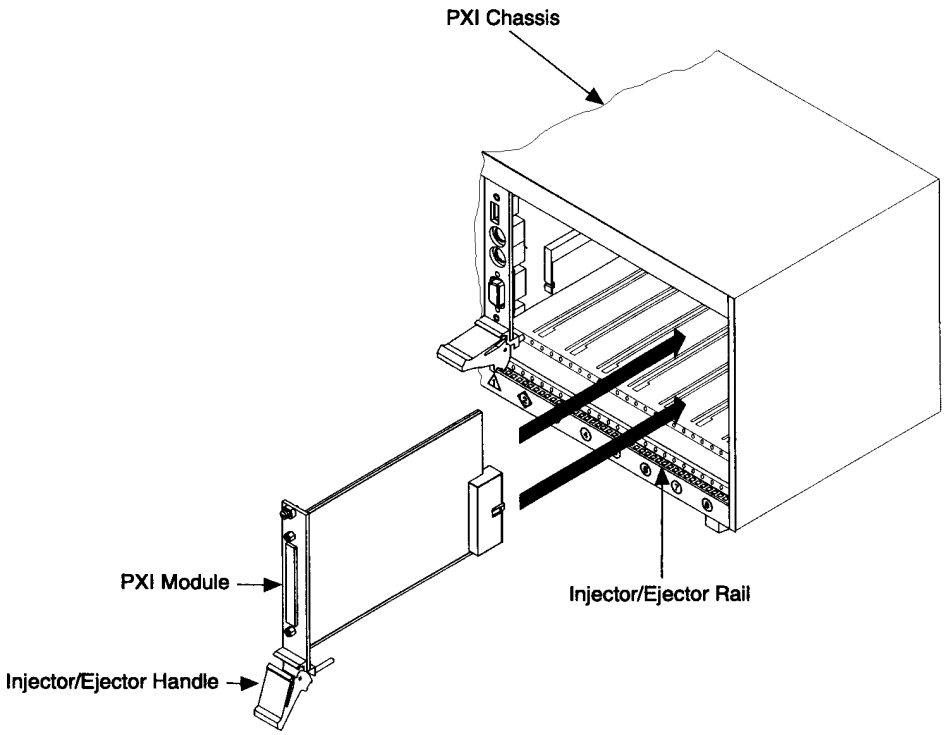


Figure 2.1 - Installing the module into a PXI Chassis

6. Raise the injector/ejector handle until the module firmly seats into the backplane. The front panel of the module should be flush with the front panel of the chassis.
7. Screw the front panel of the module to the front panel mounting rail.
8. Power-up the system as follows:
   a. For a system comprising a PC and one rack, power up the rack before powering up the PC.
   b. For a system comprising more than one rack, turn ON the last rack in the system followed by the penultimate, etc, and finally turn ON the PC.

NOTES

1. In a MXI-3 arrangement the entire system must be powered down when any change is made to its card complement.
2. There is a relationship between physical slot-numbers and logical bus/slot values.
3. The logical bus values are dynamic (eg. if a PXI-MXI-3 card is repositioned in a chassis).
4. Each module requires a Software driver. These are available on the Pickering Interfaces website at www.pickeringswitch.com.

SECTION 3 - CONNECTOR PIN OUTS

Figures 3.1 and 3.2 provide pin outs for the 40-410 Digital I/O Module.

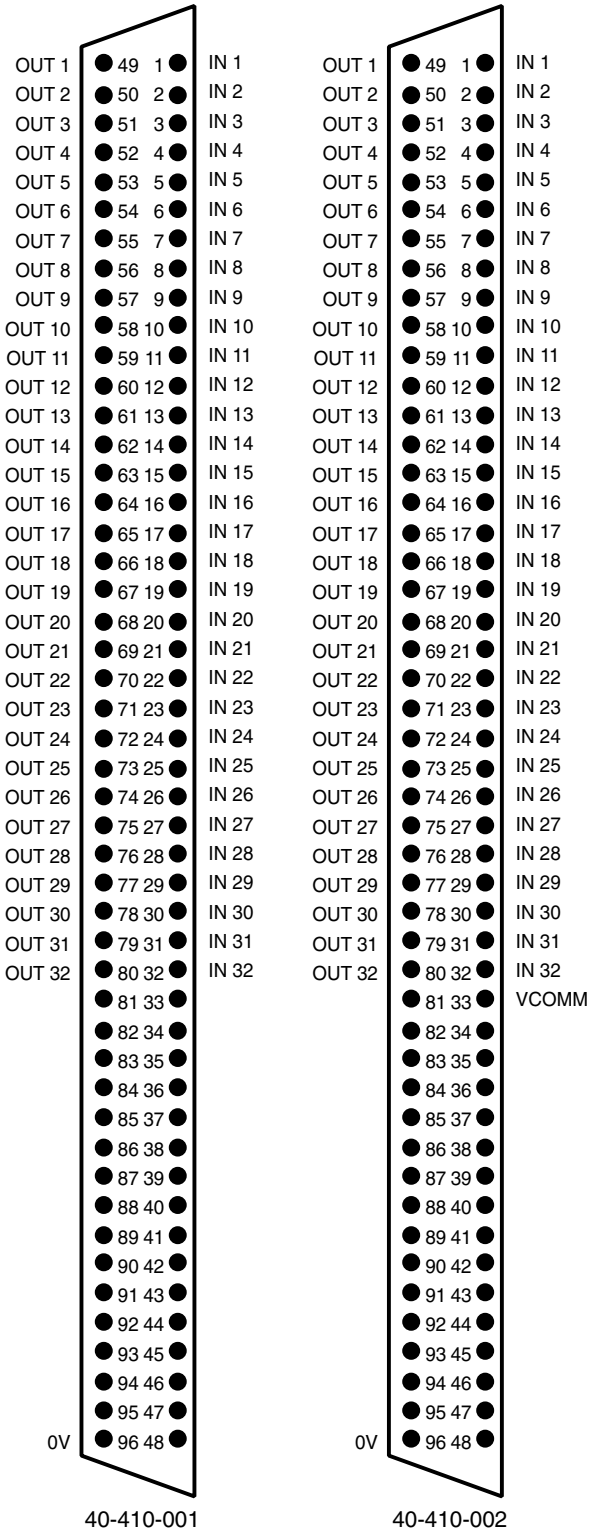


Figure 3.1 - Digital I/O Module 40-410: Pin Outs

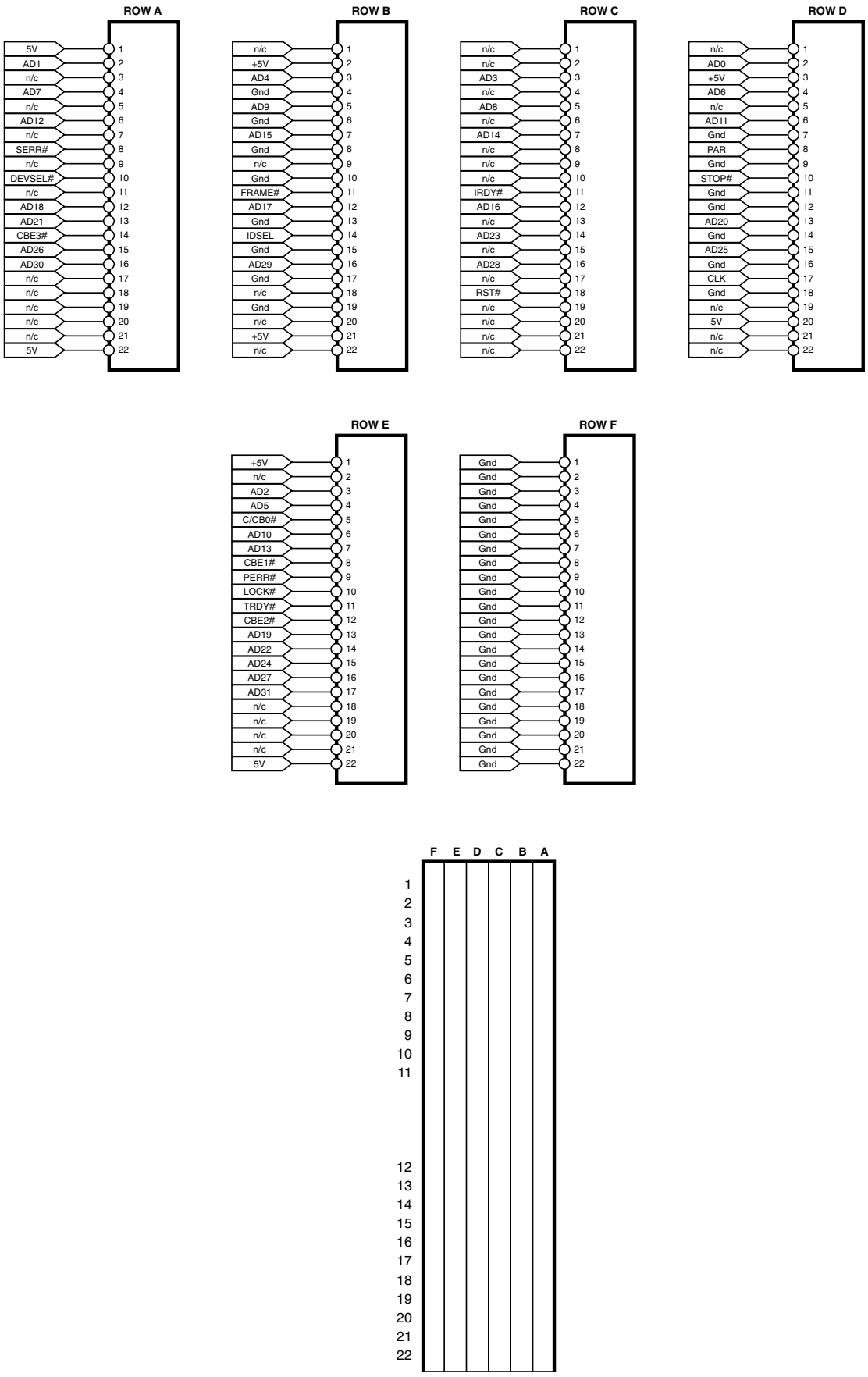


Figure 3.2 - Backplane Connector

SECTION 4 - PROGRAMMING

PROGRAMMING

Please refer to the PXI Software manual for programming information. This manual is available on the Pickering Interfaces website at www.pickeringswitch.com.

The following provides slot addresses for the Pickering Interfaces 19 inch rack:

First three slots for controller	Bus 02h					
	Slot 0fh	Slot 0eh	Slot 0dh	Slot 0bh	Slot 0ah	
Front Panel No.	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	
	Bus 03h					
	Slot 0fh	Slot 0eh	Slot 0dh	Slot 0bh	Slot 0ah	Slot 09h
Front panel No.	Slot 7	Slot 8	Slot 9	Slot 10	Slot 11	Slot 12
	Bus 04h					
	Slot 0fh	Slot 0eh	Slot 0dh	Slot 0ch	Slot 0bh	Slot 0ah
Front panel No.	Slot 13	Slot 14	Slot 15	Slot 16	Slot 17	Slot 18

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SECTION 5 - FAILURE DIAGNOSIS

There is no self-test facility provided on the 40-410 Digital I/O Module.

FAILURE DIAGNOSIS

General

In general, PCI Plug and Play functions correctly in desktop PCs, but the same cannot be guaranteed for PXI.

Many problems relate to system configuration issues. Although MXI-3 itself is a reliable technology, problems can arise by making it possible to attach a far greater number of PCI devices to a desktop PC than the BIOS is designed to handle. The BIOS may also be confused when card positions are interchanged in the chassis.

Because, in some cases, the underlying technology of PXI is not understood it is sometimes difficult to make sense of apparently bizarre system behaviour. For instance in a borderline situation, adding a new card to a functioning system can cause one of the original cards to stop working (by starving it of resources).

A lot of reported problems are related to large systems, so many points relate to them.

There also arises the problem of software conflict, in some cases another vendors' software installation has overwritten the existing Pickering Interfaces WinDriver installation with their own, older version).

In a significant proportion of cases, cards returned to Pickering Interfaces as faulty are found to be fully functional. This is another indication of problems in the host system environment.

Some fundamental issues of PXI which cause problems are:

- the need to install software drivers for the cards
- when using PCI-MXI-3, the need to power up PXI chassis before powering up the PC
- the need to power up daisy-chained PXI chassis in reverse order so that resources are detected properly
- in a MXI-3 arrangement the PXI chassis must never be switched off while the host PC is operating (being connected like an ordinary peripheral, such as a printer or a GPIB instrument, they expect it to behave like one)
- in a MXI-3 arrangement the entire system must be powered down when any change is made to it's card complement
- the apparently bizarre relationship between physical slot-numbers and logical bus/slot values
- the 'dynamic' nature of logical bus values (eg. if a PXI-MXI-3 card is repositioned in a chassis)

It should be noted that programs such as PILMon, PILDemo and PILCfg obtain exclusive access to Pickering Interfaces cards, and no other application can access the cards until those programs are quit.

USEFUL HARDWARE INFORMATION

Does the system use an embedded controller, or PCI-MXI-3 connection to a desktop PC?

An embedded controller can be expected to have a “PXI-suitable” BIOS. A standard desktop PC (or even an industrial PC that’s tailored for PCI applications) may not.

If PCI-MXI-3:

- who is the PC manufacturer?
- what BIOS does it use?

Some BIOSs cannot map more than 80 memory windows. A typical result is that when the number of cards in the system is increased beyond some point, additional cards do not function properly (or at all), or some cards that did function correctly cease to do so. The failure point is dependent upon the precise demands of motherboard devices and the installed cards. Because a typical card uses 2 windows, failure might be expected at around 35 cards. Some designs make excessive use of memory windows (upto 5 windows per card) and the problem can occur with as few as 14 such cards.

What CPU manufacturer, type and clock speed?

There are no known problems associated with particular CPU manufacturers, types, or clock speed. But with clock speeds continually rising, there is always a fear that some speed-related bug will manifest itself.

What PXI chassis is/are in use in the system?

Assuming the chassis type is recognised, the total slot-count of the system can be deduced, and the number of PCI buses involved.

If multiple chassis are in use, what connection topology is being employed (star, daisy-chain, or some combination)?
Theoretically it should not matter how the system is connected. But the overall topology determines the enumeration order of the system’s PCI buses, and consequently the physical location at which the BIOS or OS may run out of resources to allocate to cards.

What is the total slot-count of the system?

May be deduced from the chassis information, assuming the types are recognised. If not, the slot-count indicates the number of PCI buses present.

How many slots are occupied?

The installed card-count gives a rough indication of the total demand that may be placed on system resources.

What Pickering Interfaces cards are installed?

The resource requirement of the Pickering Interfaces cards fitted in the rack should be determined.

What other manufacturer’s cards are installed?

There are no known cases of conflict with particular card types from other manufacturers. PCI PnP should guarantee that all devices are assigned non-conflicting resources. Any conflicts that do occur can only be blamed on the BIOS (and/or PnP OS) for getting it wrong. However in some cases it appears that the BIOS may have been provoked into making an error by the combination of resources it was being asked to assign within a single bus segment.

Have cards been moved around in the system, or has MXI-3 connection topology been changed?

The PC's BIOS holds a picture of the system's configuration and resource assignments in NVRAM. If the configuration is altered the BIOS should re-build its picture accordingly; but in complex configurations some BIOSs corrupt.

To correct this problem in a PCI-MXI-3 arrangement:

1. Turn off the PC and all PXI chassis.
2. Turn on the PC only and allow it to boot with all PXI devices 'dead'.
3. Shut down and switch off the PC. Wait for approximately five seconds.
4. Turn on the PXI chassis and then the PC.

This should cause the BIOS to create a 'clean' picture.

Are there any 'floating' MXI-3 links?

Some systems have a 'floating' PXI-MXI-3 card installed (one that will ultimately connect to another chassis, or is connected to a chassis that is unpowered). In some cases a floating MXI-3 link will hang the computer at boot-time, or cause random system crashes. From a system viewpoint it represents "half-a-bridge" and should be avoided.

What is the exact logical PCIbus configuration of the system?

This information can be obtained using the following:
WinDriver PCI_Dump utility
The Catalyst Hot-swap utility
Windows Device Manager which can print "All devices and system summary" information, but it only shows what resources have actually been assigned, rather than those the cards might have requested.

USEFUL SOFTWARE INFORMATION

Has the Pickering software been properly installed?

The first-generation driver Pilpxi.dll and utilities that rely on it such as PILMon, PILDemo and PILCfg require WinDriver installed in the system.

The VISA driver Pipx40.dll relies on NI-VISA being installed.

When Pickering cards were installed, was the appropriate driver file used?

For the first-generation driver Pilpxi.dll, Plug and Play installation using Pilpxi.inf places the cards in the Device Manager class "Pickering Interfaces PXI". Cards will still function if installed as "Unknown" (ie. without using Pilpxi.inf).

Cards installed using Pilpxi.inf or as "Unknown" are not registered with VISA, and so are not operable by the Pipx40.dll driver or utilities such as MAX. To overcome this, first remove the affected card(s) in Device Manager. Install the latest System 40 software release, then restart. The cards should now re-install, appearing in the Device Manager class "Pickering Interfaces PXI VISA", and will be accessible to Pipx40.dll etc. Registering the cards with VISA does not prevent Pilpxi.dll from accessing the cards.

Which Pickering driver is in use (Pilpxi.dll or Pipx40.dll)?

The first-generation driver Pilpxi.dll is not reliant on NI-VISA and is usable by customers who do not have it. PXI support in NI-VISA is currently an NI extension to the VISA specification. PXI support is not guaranteed in other vendors' VISA distributions.

The VISA driver Pipx40.dll will become available soon. At some later time Pipx40ivi.dll will take over from it (though retaining all 'legacy' VISA functionality of Pipx40.dll).

What is the version of the Pickering driver?

Use of the latest available version is always recommended, because:

- new card types may need revised driver features to support them
- recently-purchased cards may not be recognised by old driver releases (because Subsystem IDs have changed versions of Pilpxi.dll prior to 1.36 will not recognise the new IDs)

PICKERING INFORMATION

Are all installed cards detected by PILMon?

If not, the likelihood is that either:

- Pilpxi.dll is too old, and cannot recognise the missing card(s)
- there is a problem with allocating system resources, and the missing card(s) have not received their proper assignments

Are all cards' attributes shown correctly by the PILMon "LS" command, and all status values = 0x00000000?

Erroneous card descriptions from "LS" are largely due to the program not being rigorous enough, and will invariably be accompanied by non-zero status values.

Non-zero status values indicate faulty card hardware or communication problems.

SECTION 6 - SPECIFICATION

ENVIRONMENTAL

Operating Temperature: 0°C to 50°C.

Storage Temperature: -20°C to 75°C.

Humidity 95% non condensing.

POWER REQUIREMENT

Power consumption from the 5V backplane supply is as follows:
0.9W + 0.25W from User 5V.

POWER SUPPLY

Choice of all four PXI system voltages (+3.3VDC, +5VDC ±12VDC) up to 1amp each (within the overall limit of the power supply). The power supplies are all fused at 1A as standard (however maximum fuse value can be changed to 8A for 3,3Vd.c. and 5A for 5Vd.c.).

DIMENSIONS

Single slot 3U PXI (CompactPCI card).

MATING CONNECTORS

96 Way SCSI 2 Female Connector
PXI bus via 32 bit P1/J1 backplane connector.

GENERAL BREADBOARD DETAILS

Square pad and DIP construction areas. Approximately 652cm (10 sq inches) of prototype area. 0.1” grid spacing.
Maximum Component Height: 13mm
Maximum Lead Length Below PCB: 2mm

TTL OUTPUT DRIVER

Maximum drive 15 TTL inputs
Max Voltage 7V
Max Current Drive Sink 8mA, Source 0.4mA
Operate/Release Time < 1ms

OPEN COLLECTOR TRANSISTOR

Driver I.C. ULN2803LW, Open Collector Driver
Maximum Standoff Volts 50V
Max Power per O/P 1.0W
Max Power per byte 1.6W
Max Current Drive 500mA.
Operate/Release Time < 1ms

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SECTION 7 - PARTS LIST

The following pages provide a parts list and component layout diagram for the Digital I/O Module 40-410.

Table 7.1 provides a parts list and Figure 7.1 a component layout diagram for the 40-410 Digital I/O Module

TABLE 7.1 - Digital I/O Module 40-410 Parts List

PCB Location	Pickering Interfaces Part Number	Part Description	Quantity
R1, R2, R16 to R23	C/RS/079	RESISTOR N/W 4 x 10k 1206	10
R3	C/RS/085	RESISTOR 10k 0805	1
R4 to R15	C/RS/102	RESISTOR N/W 4 x 10R 1206	12
RL1 to RL32, RL49	C/RL/	110/111	33
RL33 to RL48, RL50	C/RL/015	108-1-C	17
C2 to C23, C25, C27, C29 t0 C34	C/CP/034	CAPACITOR 100nF 0603	30
C1 C24, C26, C28	C/CP/024	CAPACITOR 10uF TANT SMD	4
Fuse		3.3V 1A	1
Fuse		5V 1A	1
Fuse		+12V 1A	1
Fuse		-12V 1A	1
J1	C/CN/355	cPCI CONNECTOR	1
	C/MS/071	FEMALE CODING KEY, BRILLIANT BLUE, V	1
J2	C/CP/379	SCSI3 68 PIN	1
U1	C/IC/098	PCI9050 PQFP	1
U2	C/IC/099	93CS46 DIP	1
	C/IC/035	8 PIN DIP SKT	1
U3	C/IC/056	7705 SOP	1
U4	C/IC/087	74HCT32 SOP	1
U5	C/IC/100	74HCT273 SOP	1
U6	C/IC/101	74HCT244 SOP	1
U7	C/IC/090	93C56 SOP	1
U16 to U19	C/IC/092	UCN2803LW	4
U8 to U11	C/IC/102	74ACT273 SOP	4

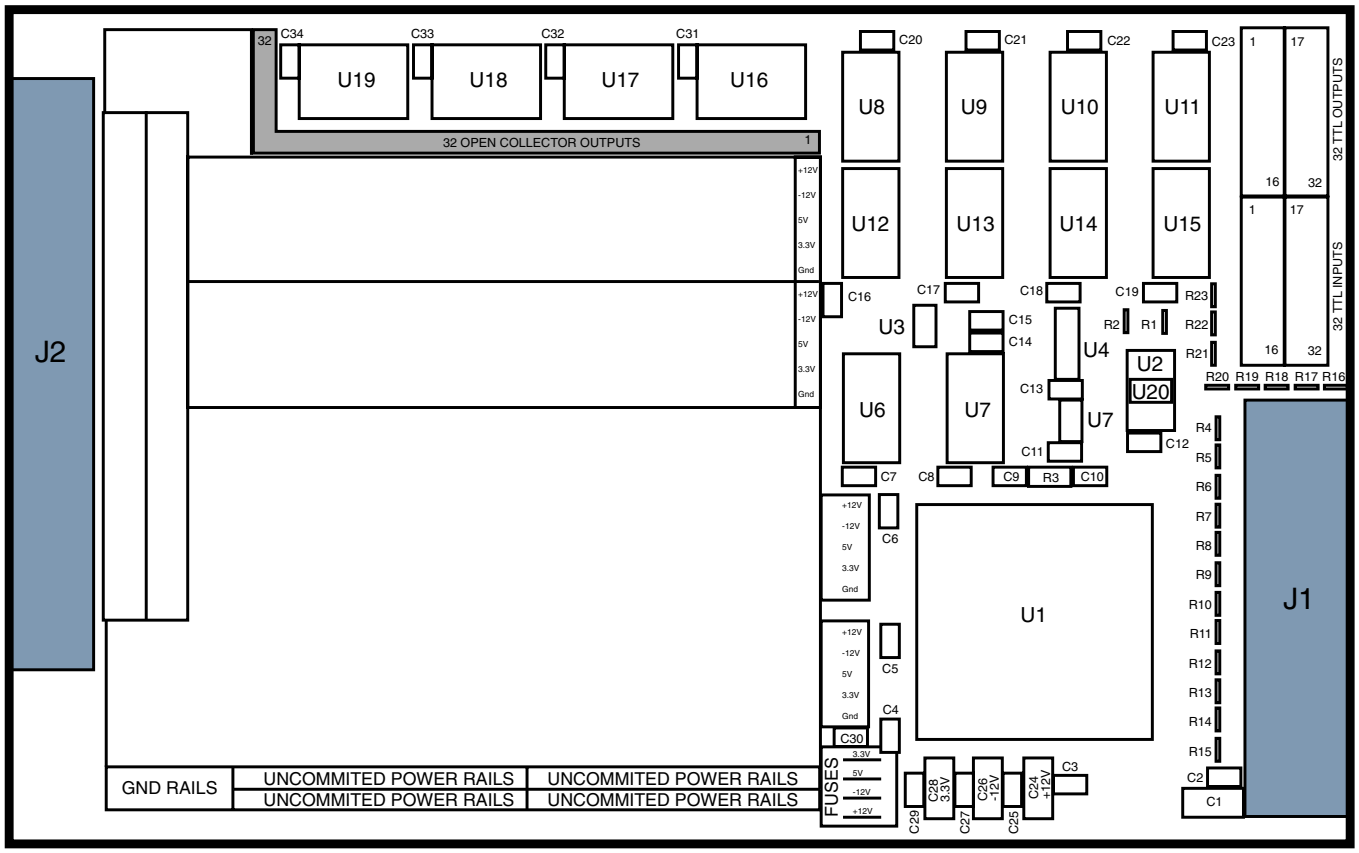

Figure 7.1 - Digital I/O Module 40-410: Component Layout

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SECTION 8 - CAUTION

CAUTION
Handling of Electrostatic-Sensitive Semiconductor Devices

Certain semiconductor devices used in the equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or sub-units containing these devices:

(1) Persons removing sub-units from an equipment using these devices must be earthed by a wrist strap and a resistor at the point provided on the equipment.

(2) Soldering irons used during the repair operations must be low voltage types with earthed tips and isolated from the mains voltage by a double insulated transformer.

(3) Outer clothing worn must be unable to generate static charges.

(4) Printed Circuit Boards (PCBs) fitted with these devices must be stored and transported in anti-static bags.

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